HASP Section 7 Monitoring

7.1 Introduction

Monitoring is the measurement of hazardous exposures to physical or chemical agents during a given time period.

During the preliminary workplace survey, the substances or conditions to which workers are exposed must be determined**.** The basic problem in exposure assessment is to recognize all physical and chemical exposures, to evaluate each as acceptable or unacceptable, and to control all unacceptable exposures.

Hazardous exposures can take various forms and include:
Chemicals (examples include lead, solvent, pesticides)
Sound
Heat/Cold
Dust (examples include asbestos, cotton, silica)
Radiation
Biological agents (examples include fungus, bacteria, virus)

Once an exposure has been determined, the problem becomes how to detect and determine the intensity of the exposure. To do this, the Incident Safety officer or designee collects samples of air or uses direct-reading instruments. Every effort must be made to obtain samples that represent the worker's exposure. Currently there is no effective direct-reading instruments for biological agents. All biological monitoring will involve colleting a sample (air, soil, wipe swath, etc…) and having the sample analyzed by a laboratory for the presence of the desired biological agent. A chemical agent may not be the agent of concern during a

deployment, however deployment activities may introduce a chemical agent into the deployment area and necessitate monitoring. Physical agent such as heat/cold issues are a possibility when working outdoors. Also most direct reading monitoring equipment is agent specific and has a concentration range for which it is accurate. Once the Site Safety Officer has completed the HAPS Form 3 (Agents) it is recommended that they confer with an SHEWB IH to assure the correct equipment is to be utilized and available. HASP Form 5 (Monitoring Equipment) is than to be completed to assure the instruments are calibrated and maintained as needed.

There are multiple objectives to monitoring. They include determining:
1. Baseline: What is the range and distribution of worker exposure(s);
2. Diagnostic: Sources and tasks that pose the greatest potential exposures in the workplace;
3. Compliance: Is this workplace in compliance with OSHA standards;

To decide what constitutes a representative sample, five basic questions must be answered:

1. What to sample for
2. Where to sample
3. Whom to sample
4. How long to sample
5. How many samples to take
6. When to sample (day/night, or what month/season)

What to sample for will be determine by environment (heat/cold, radiation, noise), by the agent of concern (is the deployment due to a chemical spill), and agents APHIS will use during the deployment (what chemicals are being utilized as part of the deployment, are radioactive sources being used). The ACGIH's TLV guide

should be utilized to aid in these determinations as well as the SHEWB IH (if needed).

Once the above is determined, a sampling plan is developed which will give an accurate overview of workers' exposure. Each sample is acquired at a particular location over a specific time interval. By its nature, sampling can only provide a snap shot of the actual situation. The more snap shots taken, the easier it is to create the big picture and the more accurate its results. By determining a statistically significant number of samples (a minimum of three), and taking sampling from a representative number of employees (not just one work area or job title), this overall picture is formed.

7.2 Sampling Methods

Monitoring protocols will be pursuant to the manufacturer's guidelines. Calibration will be performed, at a minimum, prior to each day's use in accordance with the manufacturer's guidelines. A copy of each instrument's manual will be kept in the Support Zone or in the field vehicle. All action level criteria are measured as close to the agents route of entry of the employee as possible. For inhalation chemicals in the employee's breathing zone, the CGI (a measure of flammable gas) is measured at the borehole, excavation (if performed), or well headspace, for noise the monitor would be placed as close as possible to the ear. Daily monitoring logs will be maintained by the Incident Safety Officer. These records will contain the names of all personnel conducting work, describe the work being performed, and describe any new procedures established for performing work. In addition, these records will list the types of air monitoring equipment being used; how and when this equipment was calibrated; air monitoring results; the level of PPE being used; and complete descriptions of all injuries, accidents, physical complaints, and unusual occurrences.

7.3 Non-Invasive Operations

Non-invasive operations, which do not disturb existing materials, include setup, field reconnaissance, biological surveying, geophysical and topographical surveying, and decontamination, removal of trees and brush, and miscellaneous Support Zone activities. If during the initial evaluation the Incident Safety Officer deems it necessary, one member of the field team will monitor the ambient breathing zone air continuously with a PID, which detects total hydrocarbons present in the air. The PID will be calibrated each day prior to fieldwork. A spectrophotometer or gas chromatograph should be used for more precise readings. A radiation survey meter will be used to monitor ionizing radiation at selected areas where radioactive contaminants may have been disposed.

7.4 Invasive Operations

Invasive operations include collecting soil samples, trenching/excavating, collecting groundwater and surface water samples, and soil vapor sampling. Monitoring will be performed by an individual assigned by the Operation Section Chief, such as the Incident Safety Officer, or designated individual when invasive operations are performed. A calibrated PID, radiation survey meter, and CGI may be utilized, based on available knowledge, to monitor boreholes, wells, and breathing zones during dangerous activities, excavation, and soil and groundwater sampling to determine if any hazardous material may be present that would necessitate upgrading the personnel protection level or evacuating (as per 29 CFR 1910 or ACGIH's TLV guide)

7.5 Equipment Calibration and Maintenance

After the daily briefing, the field team will field calibrate, document, and perform any required maintenance on the monitoring equipment to be used.

The satisfactory operating condition of each piece of equipment used will be verified before transport.

All equipment used for emergency operations will be checked monthly and factory calibrated annually in accordance with National Institute of Standards and Technology (NIST).

The two instruments routinely used are a PID to detect organic vapors in the atmosphere, and a radiation meter to detect ionizing radiation sources.

A CGI will be used as indicated above to detect the presence of combustible gases.

The maintenance and calibration of all monitoring equipment will be recorded in the field logbook, and on separate calibration log sheets maintained for each instrument. The radiation survey meter is calibrated annually and will not require in-field calibration.

All environmental monitoring equipment will be calibrated according to manufacturer's recommended protocol or regulatory standards (whichever is more stringent).

The operation Section Chief will ensure all field equipment is inspected and approved for use.

The following items will be recorded in the field logbooks and the calibration log sheet, at a minimum:

- Type of equipment and its identification number.
- Date of entry.
- Name and signature of individual making the entry.
- Equipment calibration status (initial "zero" reading, initial calibration gas reading, final span setting).
- Equipment nonconformance.
- Equipment inspection and repair records.

Equipment will be calibrated before and after each day's use, more frequently than once a day if field personnel suspect that calibration may have been altered (e.g., change of batteries, equipment being dropped or knocked about, significant changes in temperature or humidity).

7.6 Photoionization Detector Use

The PID is typically equipped with a 10.2 electron volt (eV) probe.

The PID detects the presence of organic gases as well as some inorganic gases. The basis for detection is the ionization of the gaseous constituent. The incoming gas molecules are subjected to ultraviolet (UV) radiation, which is energetic enough to ionize many gaseous compounds. Several different probes, with different UV energies (8.3, 9.5, 10.2, 10.9, and 11.7 eV), are available for the PID. The 10.2 eV probe is generally the most useful for environmental fieldwork as it is more durable than the 10.9 and 11.7 eV probes, and detects more compounds than the 9.5 and 8.3 eV probes.

A PID is also easier to use than a flame ionization detector (FID) and its lower detection limit is in the low parts-per-million (ppm) range. The response time is also rapid, with the meter reaching 90 percent of the indicated concentration in 3 seconds.

Since the PID is a nonspecific total vapor detector, it cannot be used to identify unknown compounds; it can only quantify them. In addition, it must be calibrated to a specific compound. It does not respond to all compounds, specifically methane or hydrogen cyanide. Only after the PID has been properly calibrated will it be used. A background reading will be taken prior to entering each area during the fieldwork, as vehicle exhaust and other common sources of gaseous pollutants may register on the meter. While operating the PID during the fieldwork, **if a reading greater than 1 ppm in excess of the background reading for that area is encountered continuously for at least 1 minute, the area will be immediately evacuated until further guidance is received from the Field Team Leader.** (The 1 ppm action level may be superseded, based upon exposure limits of known contaminants of concern). The PID will monitor the atmosphere continuously during non-invasive and invasive fieldwork. After daily use, the unit will be inspected for damage and cleanliness, and repaired or cleaned as necessary. The battery will be recharged overnight, since a low battery will cause the unit to malfunction.

7.7 Radiation Survey Meter Use

The radiation survey meter will not need to be calibrated in the field. Calibration is performed as part of the annual maintenance on the unit by the manufacturer. The radiation survey meter operates on alkaline batteries. The condition of the batteries will be checked prior to each day's activities by using the battery check

function on the meter. If the batteries are low, they will be replaced by spares carried by the field team.

Operation of the meter is as follows:

- Before attaching the probe to the meter, ensure the unit is turned off.
- Attach the probe to the meter and turn the unit on.
- Set the function switch to "Battery Check" and read the display to determine if the batteries need replacing.
- If the batteries are in good condition, set the function switch to read from 0-10 mR/hour.
- Background levels of radiation throughout the United States will typically range between 5 and 100 µR/hr.

The NRC limits the radiation level in an unrestricted area, i.e., an area accessible to members of the public, to no greater than 2 mR/hr. Therefore, while operating the radiation survey meter during fieldwork, **if a reading in excess of 2 mR/hr is observed, the area will be immediately evacuated until further guidance is received from the Operation Section Chief.**

After use, the unit will be inspected for damage and cleanliness, and repaired or cleaned as necessary. The batteries in the unit will be replaced as necessary.

7.8 Combustible Gas Indicator Use

A CGI will be used to monitor the work zone. The MSA Model 260 Combustible Gas and Oxygen Alarm is a hand-carried, battery-operated instrument. It is used to sample atmospheres for combustible gases or vapors and oxygen content and warn the user when predetermined concentrations of either are reached.

The monitor will only detect combustible gases and vapors in air. It will not indicate the presence of combustible airborne mists or dusts such as lubricating oils, coal dust, or grain dust.

The lack of a response on this meter does NOT guarantee that the environment is safe. If the presence of combustible mists or dusts is suspected, the area will be immediately evacuated until further guidance is received from the Operation Section Chief.

The CGI, as with the PID will not read concentrations of specific toxic compounds. The CGI operates by combusting flammable components of the vapor/gas sample on the surface of a platinum filament that increases the temperature of the filament. The rise in temperature increases the electrical resistance, reducing the current through the detector that is measured through a potentiometer. The change in current is indicated by an increase in the deflection of the meter. The meter reads 0-100 percent of the Lower Explosive Limit (LEL). When concentrations are above LEL, the meter will indicate greater than 100 percent. With most CGIs, the meter will return to 0 when concentrations are greater than the Upper Explosive Limit (UEL). If CGI measurements in the work zone area are equal to or less than 10 percent of the LEL, work can continue with caution using continuous monitoring; if the work area measurements exceed 10 percent of the LEL all operations must cease, and the area must be evacuated and permitted to ventilate. The CGI will be set to alarm at 10 percent of the LEL, and will be positioned as close as possible to the source during sampling. In addition, readings will be taken directly at the borehole every 15 minutes. The Operation Section Chief, will direct the Incident Safety Officer to periodically check the CGI readings for the area to determine if the work may proceed. The instrument sensitivity can be reduced by the following compounds: selenium compounds, silicon compounds, and volatile heavy metals such as tetraethyl

lead. High humidity may reduce sensitivity. Halogenated hydrocarbons corrode the filament. The sensitivity of the CGI varies with different vapors and gases so it is only truly accurate when measuring the calibration gas.

7.9 Oxygen Metter Use

Breathable air contains 20.8% oxygen. Oxygen levels at or below 19.5% and at or above 23% are considered Immediately Dangerous to Life and Health (IDLH). For areas where oxygen levels are in question, an oxygen level meter should be utilized. Confined spaces and areas where asphyxiants are used both pose the possibility of decreased oxygen levels.

7.9 Air Monitoring Action Levels

The air monitoring action levels and required response when an action level is exceeded will be included in the Work plan if contaminants of concern are known.

General requirements for air monitoring are described below.

• For organic vapors, the level of PPE will be raised from EPA Modified Level D to Level C if the PID detects concentrations greater than the values listed in the Work plan for the compounds suspected to be present at the individual study areas. When insufficient information is available to project what contaminants are likely to be present, background measurements of organic vapor concentrations will be taken upwind of the study area and **if at any time a reading of 1 ppm above background is indicated on the PID continuously for at least 1 minute, or a reading above 2 mR/hr is detected on the radiation survey meter, all personnel will evacuate the area until further guidance is**

received from the Operation Section Chief. (The 1 ppm action level may be superseded in the Work plan, based upon exposure limits of known contaminants of concern). Upon receipt of notice to proceed, PPE will be upgraded to Level C. If dusty conditions occur, or are generated during sampling activities, appropriate respiratory protection will be worn when performing operations where contaminants of concern may be, or become, airborne.

• If combustible gas levels at the borehole exceed 10 percent and the alarm sounds, the area will be evacuated until the levels dissipate and the Incident Safety Officer determines that it is safe to return to the area. It may be necessary to flood the borehole with air or clean water to help dissipate the combustible gases. If the combustible gas concentrations cannot be lowered using engineering controls, the borehole will be abandoned and a new location selected.

• If the alarm is triggered on the CGI, field activities will cease until the CGI reading is reduced to less than 10 percent of the LEL. Although work will be conducted in the ambient environment and no change in oxygen concentration is expected, oxygen indicator readings less than 19.5 percent or greater than 23 percent also will be cause to halt work and evacuate the area. The CGI will operate continuously during activities if combustible contaminants are suspected.

7.10 References

ACGIH (American Conference of Governmental Industrial Hygienists), 1994-1995. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*.

ACGIH, 1987. *Guidelines for the selection of chemical protective clothing*; Third Edition, February.

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